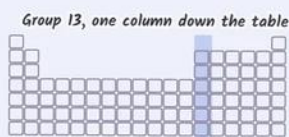


The p-Block Elements (Group 13 and 14)

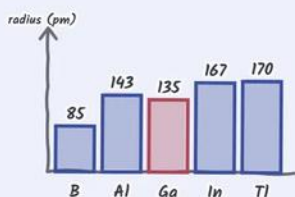
boron's family and carbon's family, and the one anomaly each has at its head

Group 13: the boron family

- members: boron (B), aluminium (Al), gallium (Ga), indium (In), thallium (Tl); valence config ns^2np^1
- three valence electrons: expected oxidation state is +3
- going down the group, +1 becomes increasingly stable, most notably for Tl
- boron alone is a non-metal or metalloid; the rest are true metals
- atomic size and metallic character generally increase down the group; ionisation enthalpy falls
- the +1 state gets more STABLE down the group, so its reducing power FALLS



the periodic table's grid, with the single column that is Group 13 banded



atomic radius down Group 13: rises overall but dips at Ga, poorly shielded by the 3d electrons that appear right before it

Anomalous boron vs its own family *

property	boron	Al and heavier members
character	non-metal / metalloid	metallic
stable +1 state	essentially absent	grows down the group (Ga, In, Tl)
maximum covalency	4 (no d orbitals available)	6 (d orbitals available from Al onward)
oxide/hydroxide nature	acidic (B_2O_3)	amphoteric (Al_2O_3) to basic lower down

boron's small size and lack of d orbitals in its valence shell make it the odd one out in almost every property, the same first-member anomaly that shows up across the p-block

the first member of a p-block group is almost always the exception; boron here, carbon in the next group, both too small and too electron-poor to behave like their own heavier relatives

Inert pair effect

- inert pair effect: the ns^2 pair grows reluctant to bond as Z rises down a group
- it stays back as a lone pair instead of being used
- strengthens down a group: ns electrons sit close to the nucleus
- poorly shielded by the d and f electrons lower in the group, so held tightly
- in Group 13: explains why Tl^+ is more stable than Tl^{3+} , not the naive guess
- in Group 14: same effect makes Pb^{2+} more stable than Pb^{4+}
- for carbon and silicon, +4 stays the dominant state